UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/555,716	11/07/2005	Guenter Spahlinger	L-409	2703

7590 09/10/2008	EXAMINER
Elliott N Kramsky	VLAHOS, SOPHIA
Suite 400	
5850 Canoga Avenue	
Woodland Hills, CA 91367	

ART UNIT	PAPER NUMBER
2611	

MAIL DATE	DELIVERY MODE
09/10/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *22 November 2006*.

2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-61* is/are pending in the application.

    4a) Of the above claim(s) *1-31* is/are withdrawn from consideration.

5) ☒ Claim(s) *53-61* is/are allowed.

6) ☒ Claim(s) *32-39 and 42-46* is/are rejected.

7) ☒ Claim(s) *40 and 41* is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *07 November 2005* is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All   b) ☐ Some * c) ☒ None of:

        1. ☒ Certified copies of the priority documents have been received.

        2. ☐ Certified copies of the priority documents have been received in Application No. _____.

        3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date *11/07/05*.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Priority

1.   Acknowledgment is made of applicant's claim for foreign priority based on an

application filed in Germany on 5/08/03. It is noted, however, that applicant has not

filed a certified copy of the DE 103 20 674.4 application as required by 35

U.S.C. 119(b).

Drawings

2.   The drawings are objected to because of the following minor informalities:

Figures 3-6, 8 are graphs but their vertical & horizontal axes are not labeled to indicate

what quantities are plotted Corrected drawing sheets in compliance with 37 CFR

1.121(d) are required in reply to the Office action to avoid abandonment of the

application. Any amended replacement drawing sheet should include all of the figures

appearing on the immediate prior version of the sheet, even if only one figure is being

amended. The figure or figure number of an amended drawing should not be labeled as

"amended." If a drawing figure is to be canceled, the appropriate figure must be

removed from the replacement sheet, and where necessary, the remaining figures must

be renumbered and appropriate changes made to the brief description of the several

views of the drawings for consistency. Additional replacement sheets may be necessary

to show the renumbering of the remaining figures. Each drawing sheet submitted after

the filing date of an application must be labeled in the top margin as either

"Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are

not accepted by the examiner, the applicant will be notified and informed of any required

corrective action in the next Office action. The objection to the drawings will not be held

in abeyance.

Claim Objections

3.   Claims 32, 36, 38 are objected to because of the following informalities: Claim

32 recites (line 3 after the preamble) "a single conversion stage" and claims 36, 38 refer

to a "signal conversion stage". Consistent terminology should be used in claims 32, 36,

38 to refer to the conversion stage.

Claim Rejections - 35 USC § 103

4.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

5.   Claims 32-35, 37, 39, 42-43, 46 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Khoury et al. (U.S. 6,121,910) in view of Schweickert et al. (U.S.

6,801,590) and Shaeffer (U.S.7,248,628).

With respect to claim 32, Khoury et al. disclose: a subtraction stage which

produces a control error signal from the difference between the input signal and a

feedback signal (Fig. 2, adder 102, which adds a negative feedback signal F (this is a

subtraction) from input signal, column 4, lines 45-49); a single conversion stage, which

converts the control error signal to a control signal (Fig. 2, block 104, filters the control

error signal and the filtered output signal corresponds to a control signal, since the value

of it controls the operation of the rest of the circuit in Fig. 2, column 4, lines 49-53,

column 5, lines 32-33); a first multiplication stage (Fig. 2 see multiplier 206, (complex

analog mixer), column 5, lines 30-33), which multiplies the control signal by a complex

mixing signal oscillating at the frequency ω_0, (see Fig. 3 shows details of Fig. 2, column

4, lines 11-16, see the mixing signals, column 5, lines 41-47, column 4, lines 53-62, see

case where translation to a higher frequency takes place, this corresponds to up-mixing)

and thus produces at least one of a real part and an imaginary part of a control signal

which has been up-mixed by ω_0, (Fig. 3 shows the separate real and imaginary parts of

the control signal B, up-mixed by famix, column 5, lines 41-47, column 4, lines 53-62) a

quantization stage (Fig. 2 see block 208, a complex quantizer, see column 5, lines 33-

36), which quantizes at least one of the real part and imaginary part of the control signal

which has been up-mixed by ω_0 (Fig. 2 and column 5, lines 33-36 quantizes both real

and imaginary part of the up-converted control signal) and thus produces the pulsed

signal (Fig. 2 , output of block 208, the quantizer is I/Q digital output signal which

corresponds to the pulsed signal); and with the pulse modulator being operated at a

sampling frequency ω_A which is 2 to 1000 times higher than the mixing frequency ω_0

(column 7, lines 21-24 where the sampling frequency of block 108 of frequency

translating $\Sigma\Delta$ modulator 100 shown in Fig. 2 comprises a pulse modulator, is fs=4fmix it

is 4 times higher than the mixing frequency output by the local oscillator); a feedback

unit, which uses the pulsed signal to produce the feedback signal for -the subtraction

stage (Fig. 2, section 109, is the feedback branch, see column 5, lines 9-26 describe using the pulsed signal to generate the signal F which is subtracted by adder 102 of Fig. 2).

Khoury et al. do not expressly teach: a complex input signal; with the pulse signal which is produced by the at least one pulse modulator being uses for electrostatic oscillation stimulation of a resonator.

In the same field of endeavor, Schweickert et al. disclose: a complex input signal (Fig. 2, complex input signal out of block 40, column 2, lines 47-49, see the complex analog signal).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the system of Khoury et al. based on the teachings of Schweickert, so that the input signal is a complex input signal, the rationale for such a modification depends on the particular application and the type of signals being processed.

In the field of sigma-delta modulator applications, Shaeffer discloses: with the pulse signal which is produced by an at least one pulse modulator being used for electrostatic oscillation stimulation of a resonator (Fig. 2, where blocks 204, 206 comprise a pulse modulator, outputting signal 214, to resonator filter 208, column 2, lines 59-63, column 4, lines 54-56).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the system of Khoury et al. as modified by Schweickert et al. based on the teachings of Schaeffer so that it is used to combine an analog signal with

a correlating signal to obtain a resulting signal that is subsequently filtered and sampled

(Schaeffer, column 1, lines 6-24, column 2, lines 49-58).

With respect to claim 33, Shaeffer et al. further disclose: characterized in that the

mixing frequency ω_0 of the pulse modulator corresponds to one resonant frequency of

the resonator (see column 4, lines 60-63, case when the correlating signal has zero

frequency).

At the time of the invention, it would have been obvious to a person of ordinary

skill in the art to modify the system of Khoury et al. as modified by Schweickert et al.

based on the teachings of Schaeffer so that it is used to combine analog signals with a

correlating signal.

With respect to claim 34, the system obtained by modifying Khoury et al. based

on the teachings of Schweickert et al further includes: characterized in that the pulse

modulator has an in-phase signal path for processing of the real part of the input signal,

as well as a quadrature signal path for processing of the imaginary part of the input

signal (see Fig. 2 of Schweickert, where separate paths for the I and Q signals are

shown and Fig. 2 of Khoury et al. where when modified by the teachings of Schweickert

et al, also includes separate paths for the I and Q input signals).

With respect to claim 35, the system obtained by modifying Khoury based on the

teachings of Schweickert et al further includes: characterized in that the control error

signal, the control signal and the feedback signal are each complex signals, which each

have a real signal component as well as an imaginary signal component (the system of

Khoury was modified to process complex input signals (with real and imaginary

components as shown by Schweickert et al), therefore in the modified system shown in

Fig. 2 of Khoury is configured to processes complex signals, therefore the control error

signal, the control signal and the feedback signal are each complex signals, so that

addition, filtering and other operations are consistently performed on the same type of

signals (in this case complex signals))

With respect to claim 39, Khoury et al. disclose: characterized in that the first

multiplication stage (Fig. 3, blocks to the right of block 104) has a first multiplier for the

in-phase signal path (Fig. 3, multiplier 302 used for the I-path) and a second multiplier

for the quadrature signal path (Fig. 3 multiplier 306 used for the Q-path), with the first

multiplier multiplying the real part of the control signal by the real part of the complex

mixing signal oscillating at a frequency ω_0, (Fig. 3, the LO signal (out of block 304) with

0 degree phase shift corresponds to the real part of the complex mixing signal) and thus

producing a first result signal (Fig. 3, C_I is the first result signal), and with the second

multiplier multiplying the imaginary part of the control signal by the imaginary part of the

complex signal oscillating at the frequency ω_0, (Fig. 3, the LO signal (out of block 304)

with 90 degree phase shift, corresponds to the imaginary part of the complex signal

oscillating at the frequency ω_0) and thus producing a second result signal (Fig. 3, C_Q is

the second result signal),

With respect to claim 42, Khoury et al. further disclose: characterized in that a

noise level is added to the input signal to the quantization stage (see column 7, 50-51,

59-62, see additive white noise of sigma-delta modulators).

With respect to claim 43, Khoury et al. do not disclose details about the nature of

the quantization stage. I.e. Khoury et al. do not expressly teach: characterized in that

the quantization stage carries out binary quantization or ternary quantization of its

respective input signal.

However, Schaeffer et al. disclose: a quantization stage, the quantization stage

carries out binary quantization or ternary quantization of its respective input signal (Fig.

3, see output of sigma delta modulator which includes a quantization stage, (see

column 3, lines 29-30) which performs binary quantization (-1, 1) as shown in Fig. 3).

At the time of the invention, it would have been obvious to a person of ordinary

skill in the art to modify the system of Khoury et al. based on the teachings of Schaeffer

so that quantization with two values is performed so that complexity is reduced.

With respect to claim 46, neither Khoury et al. nor Schweickert or Shaeffer

expressly teach: characterized in that the pulse modulator is implemented with the aid

of a digital signal processor.

However, digital signal processors (DSPs) are known in the art and allow real

time and high speed signal processing. Therefore at the time of the invention, it would

have been obvious to a person of ordinary skill in the art to modify the system of Khoury

et al. so that a large number of computations (such as those of the system of Fig. 1) are

performed in real time.

6.   Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khoury

et al. (U.S. 6,121,910) in view of Schweickert et al. (U.S. 6,801,590) and Shaeffer

(U.S.7,248,628) as applied to claim 32 and further in view of Roza (U.S. 6,087,968).

With respect to claim 36 all of the limitations of claim 36 are rejected above in

claim 32 but neither Khoury et al. nor Schweickert or Shaeffer expressly teach:

characterized in that the signal conversion stage has an integrator stage which

integrates the control error signal and produces an integrated signal as the control

signal (instead Khoury discloses the single (or signal) conversion stage comprising a

filter 104).

In the same field of endeavor, Roza discloses: a signal conversion stage has an

integrator stage which integrates a control error signal and produces an integrated

signal as the control signal (Fig. 1, block 5 is an integrator (or lowpass filter), and it

integrates a difference signal from subtracter 4 (this signal is a control error signal) and

supplies the integrated output signal which is a control signal to the next block 6,

column 3, lines 49-56).

At the time of the invention it would have been obvious to a person of ordinary

skill in the art to modify the system of Khoury et al. based on the teachings of Roza so

that an integrator is used that averages/smoothes the signal which is input to it (the

integrator) so that any variations in the control error signal are smoothed out by the

integrator.

7.   Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khoury

et al. (U.S. 6,121,910) in view of Schweickert et al. (U.S. 6,801,590) Shaeffer

(U.S.7,248,628) and Roza (U.S. 6,087,968) as applied to claim 36 above, and further in

view of Barrett Jr. et al. (U.S. 6,275,540).

With respect to claim 37, neither Khoury et al. nor Schweickert et al. Shaeffer or

Roza expressly teach: characterized in that the integrator stage gas a first integrator for

the in-phase signal path and a second integrator for the quadrature signal path, with the

first integrator integrating the real part of the control error signal, and with the second

integrator integrating the imaginary part of the control error signal.

In the same field of endeavor, Barrett Jr. et al. teaches separate integrator (first

and second integrators) for the in-phase and quadrature signal paths (Fig. 2 and Fig. 4,

integrators inside each of the $\Sigma\Delta$ modulators 222, 224 of Fig. 2 include a integrator

stage such as the one (306 if Fig. 4)).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Khoury et al. based on the teachings of Barrett Jr. et al so that the in-phase and quadrature signal paths have separate integrators to process the real and imaginary components of the complex control error signal, since the system of Khoury et al. processes complex signals (signals with real and imaginary parts) which require separate processing paths (this means separate processing components as well, such as integrators).

8.   Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khoury et al. (U.S. 6,121,910) in view of Schweickert et al. (U.S. 6,801,590) Shaeffer (U.S.7,248,628) and Roza (U.S. 6,087,968) as applied to claim 36 above, and further in view of Xu (U.S. 6,768,435).

With respect to claim 38 neither Khoury et al. nor Schweickert et al. or Shaeffer or Roza expressly teach: characterized in that the signal conversion stage has an amplifier stage.

In the same field of endeavor (band-pass sigma-delta modulators) Xu discloses: a signal conversion stage having an amplifier stage (Fig. 3, signal conversion stage comprises block 2 and 6 (a gain stage), column 3, lines 29-31).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the system of Khoury et al. so that the conversion stage of Khoury (Fig. 2, filter 104) has an amplifier stage, so that the output of the filter is adjusted by the gain stage (Xu, column 3, lines 29-31).

9.   Claims 44-45 rejected under 35 U.S.C. 103(a) as being unpatentable over

Khoury et al. (U.S. 6,121,910) in view of Schweickert et al. (U.S. 6,801,590) and

Shaeffer (U.S. 7,248,628) as applied to claim 32, and further in view of Koslov et al

(U.S. 6,052.701).

With respect to claim 44, Khoury et al. further disclose: characterized in that the

feedback unit has a second multiplication stage, which multiplies the pulses signal by a

mixing signal oscillating at the frequency ω_0, and thus produces the feedback signal

down-mixed by ω_0, for the subtractor (Fig. 2, components inside feedback section 109

include mixer 210 which mixes the pulses signal out of 208 with LOd at fdmix see

column 3, lines 44-51, where the resultant feedback signal has a frequency equal to the

input frequency (this part implies that the digital mixer down-converts the pulsed signal

by ω_0 to undo the up-conversion by ω_0 that was performed in the feed forward section

107, and obtain the feedback signal that has a frequency equal to the input frequency).

Khoury et al. do not expressly teach: a complex-conjugate mixing signal.

In the field of complex signal up-conversion-down-conversion, Koslov et al. disclose: a

complex-conjugate mixing signal (Fig. 16, see complex-conjugate mixing signal,

supplied to down mixer 606, column 11, lines 10-28).

At the time of the invention, it would have been obvious to a person of ordinary

skill in the art to modify the system of Khoury et al. based on the teachings of Koslov et

al. so that down conversion is performed by a simple mathematical operation (complex

conjugate, by swapping the real and imaginary components of the complex oscillator

output).

With respect to claim 45, the system obtained by modifying the system of Khoury et al. based on the teachings of Koslov et al. further includes: characterized in that the second multiplication stage has third multiplier of production of the real part of the feedback signal (Fig. 3, mixer 308 for used in the real I feedback signal path) and has a fourth multiplier for production of the imaginary part of the feedback signal (Fig. 3, mixer 312, in the imaginary Q feedback signal path), with the third multiplier multiplying the pulses signal by the real part of the complex of the complex-conjugate mixing signal oscillating at the frequency ω_0, and with the fourth multiplier multiplying the pulsed signal by the imaginary part of the complex-conjugate mixing signal at the frequency ω_0 (as modified by Koslov et al. the system of Khoury uses a complex conjugate mixing signal to down convert the I and Q signals out of block 208, and see in Fig. 3 the real path uses the real component of the LO signal (the real part of the complex conjugate mixing signal) and the Q path uses the imaginary (90 degree shift) of the LO signal (the imaginary part of the complex conjugate mixing signal)).

10.   Claims 47, 49-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khoury et al. (U.S. 6,121,910) in view of Schweickert et al. (U.S. 6,801,590).

With respect to claim 47, claim 47 is rejected based on a rationale similar to the one used to reject claim 32 above.

Claims 49-51, are rejected is rejected based on a rationale similar to the one used to reject claim 34-35, 42 above.

11.   Claim 48 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khoury et al. (U.S. 6,121,910) in view of Schweickert et al. (U.S. 6,801,590), as applied to claim 47 above and further in view of Therssen (U.S. 5,450,028).

With respect to claim 48, neither Khoury et al. nor Schweickert et al. expressly teach: characterized in that the pulse modulator is followed by a bandpass fitler, preferably a crystal or ceramic filter.

In the field of signal processing, Therssen discloses: a pulse modulator followed by a bandpass fitler, preferably a crystal or ceramic filter (Fig. 3, pulse modulator comprises Σ-Δ modulator 9 and frequency-divider 7, are followed by band-pass filter 31, column 3, lines 13-15).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the system of Khoury et al. based on the teachings of Therssen to pass a frequency band of interest.

12.   Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khoury et al. (U.S. 6,121,910) in view of Schweickert et al. (U.S. 6,801,590), as applied to 47 above and further in view of Koslov et al (U.S. 6,052.701).

Claim 52 is rejected based on a rationale similar to the one used to reject claim 44 above.

Allowable Subject Matter

13.   Claims 40-41 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

14.   The following is a statement of reasons for the indication of allowable subject matter: the prior art of the record fails to teach or suggest alone or in combination: A method for pulse modulation of a complex input signal, characterized by the following steps: quantization of at least on of the real part and imaginary part of the control signal, up-mixed by ω_0, in order to produce a pulsed signal, with the pulsed signal being used for electrostatic stimulation of a micromechanical resonator, as recited in claim 53 and in combination with other steps of the claim.

Claims 53-61 are allowed.

Conclusion

15.   The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

        Leung (U.S. 6,064,871)

<u>Contact Information</u>

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SOPHIA VLAHOS whose telephone number is (571)272-5507. The examiner can normally be reached on MTWRF 8:30-17:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammed Ghayour can be reached on 571 272 3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SOPHIA VLAHOS/
Examiner, Art Unit 2611
9/10/2008

/Mohammad H Ghayour/

Supervisory Patent Examiner, Art Unit 2611